Internal corrosion in steel water pipes: revisiting a solved problem

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Internal corrosion of steel water pipes is well known to be limited by the formation of a chalk-rust layer. This layer effectively controls the residual corrosion rate and results in acceptable durability of this system. Unfortunately, a number of recent examples of damage in water pipes caused by internal corrosion have raised some fundamental questions with respect to the conditions required to allow for the formation of the protective surface layer. These aspects are discussed based on thermodynamic as well as kinetic considerations and compared to the practical experience. Based on this analysis the effect of oxygen, carbonate hardness as well as total hardness receive new attention. Ignoring these parameters in water treatment makes an appropriate control of corrosion and an assessment of the residual risk impossible.